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Schneider

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[54] METHOD FOR THE MANUFACTURE OF A ROLLER SHUTTER SLAT

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[30] **Foreign Application Priority Data**

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Nov. 15, 1990 [DE] Fed. Rep. of Germany 4036410

[51] **Int. Cl.**[5] **B21D 35/00**
[52] **U.S. Cl.** **29/469.5**; 160/235
[58] **Field of Search** 29/469.5, 514; 156/196, 156/217, 324.4; 72/46, 52; 160/235, 236

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[57] **ABSTRACT**

The invention refers to a dimensionally stable roller shutter slat consisting of an aluminium strip plastic-coated on one side at least in part, and roll-formed into a hollow section **18** with the coated side inwards, the hollow section featuring upper and lower connecting areas with double-layer aluminum strip and an inside wall **14** as well as an outside wall **13**, said hollow section featuring for the increase of the longitudinal stiffness and durability of the roller shutter slat at least one contact point **15**, at which at least two aluminum strip layers are bonded connected with one another.

9 Claims, 4 Drawing Sheets

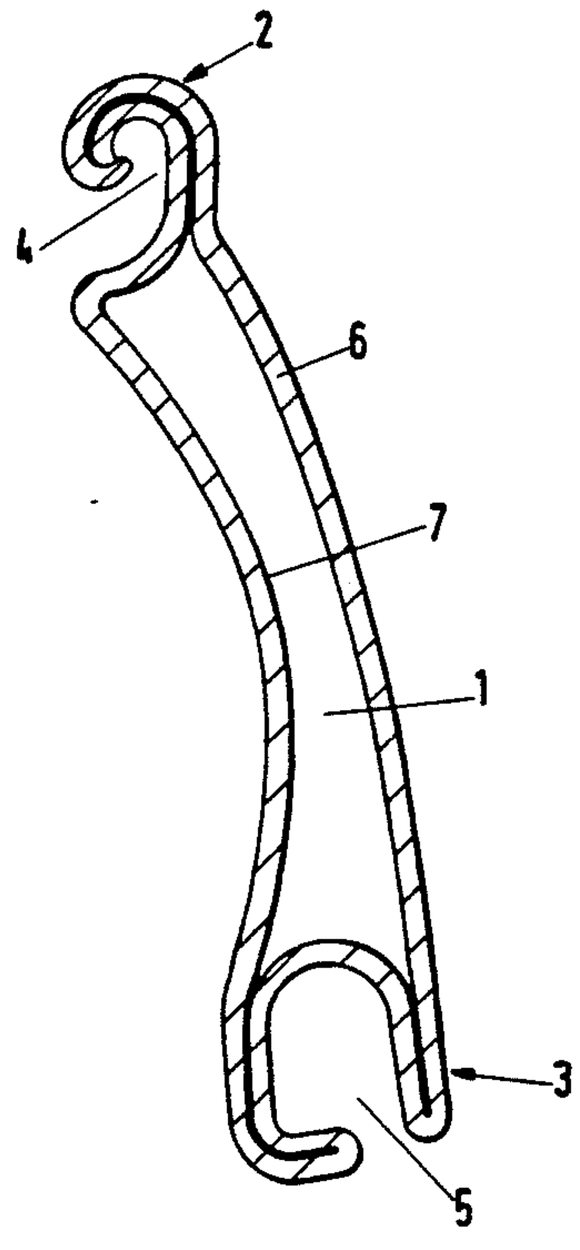


Fig.1

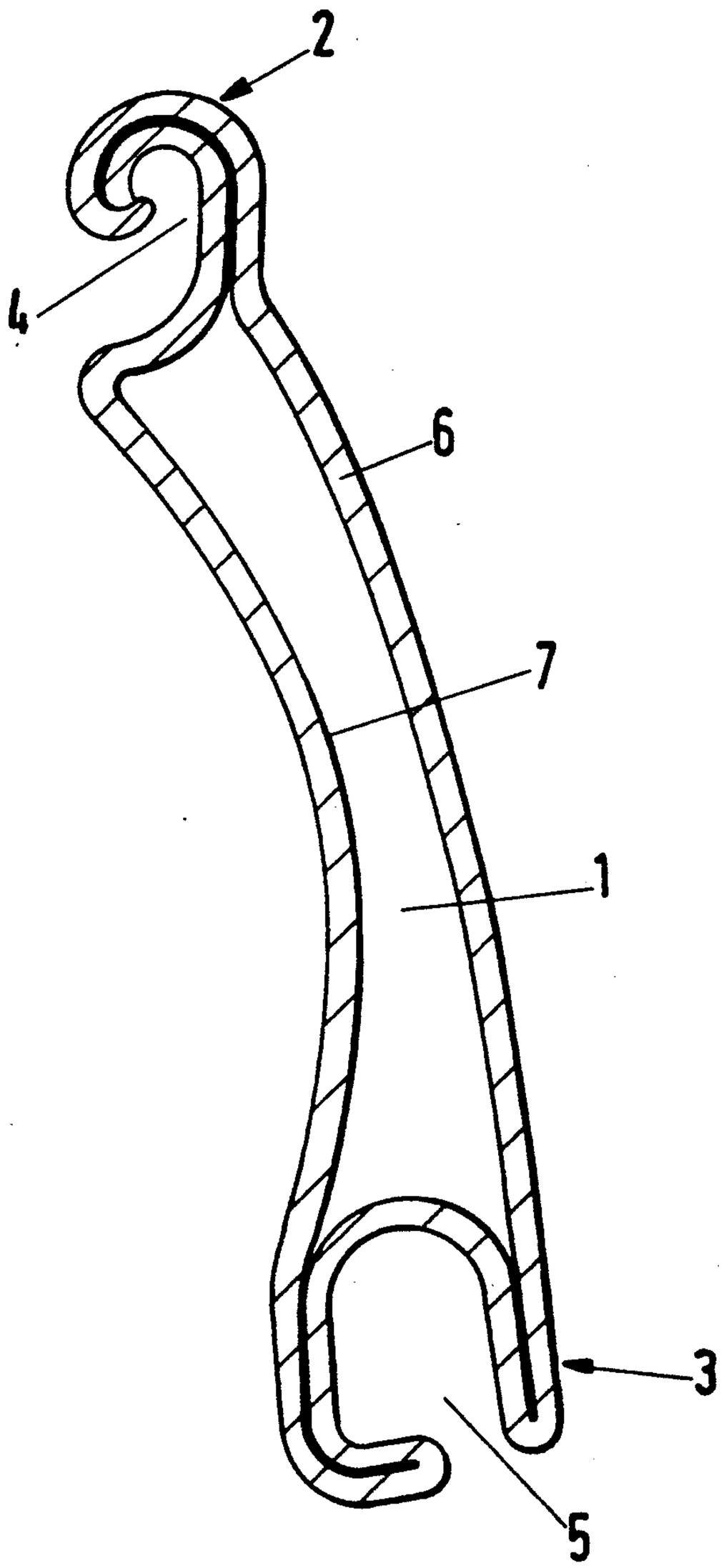


Fig.2

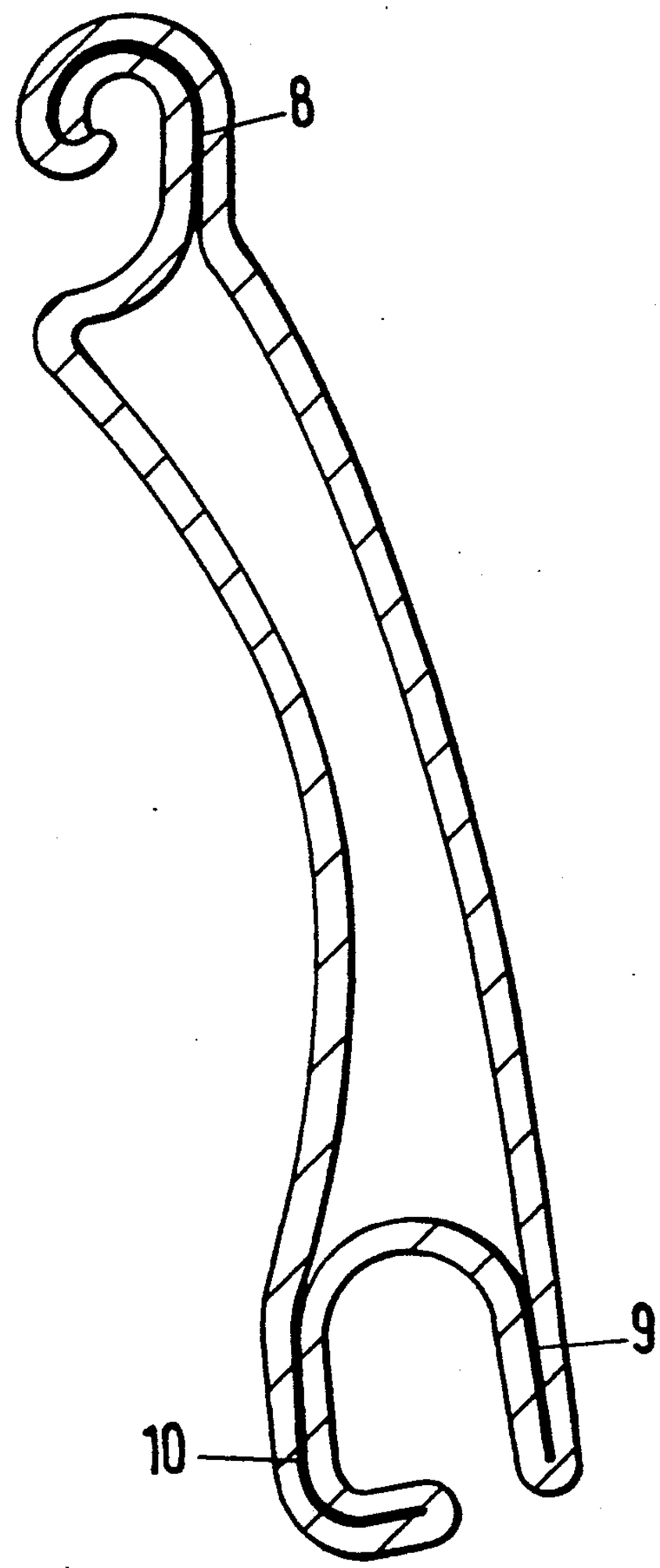


Fig.3

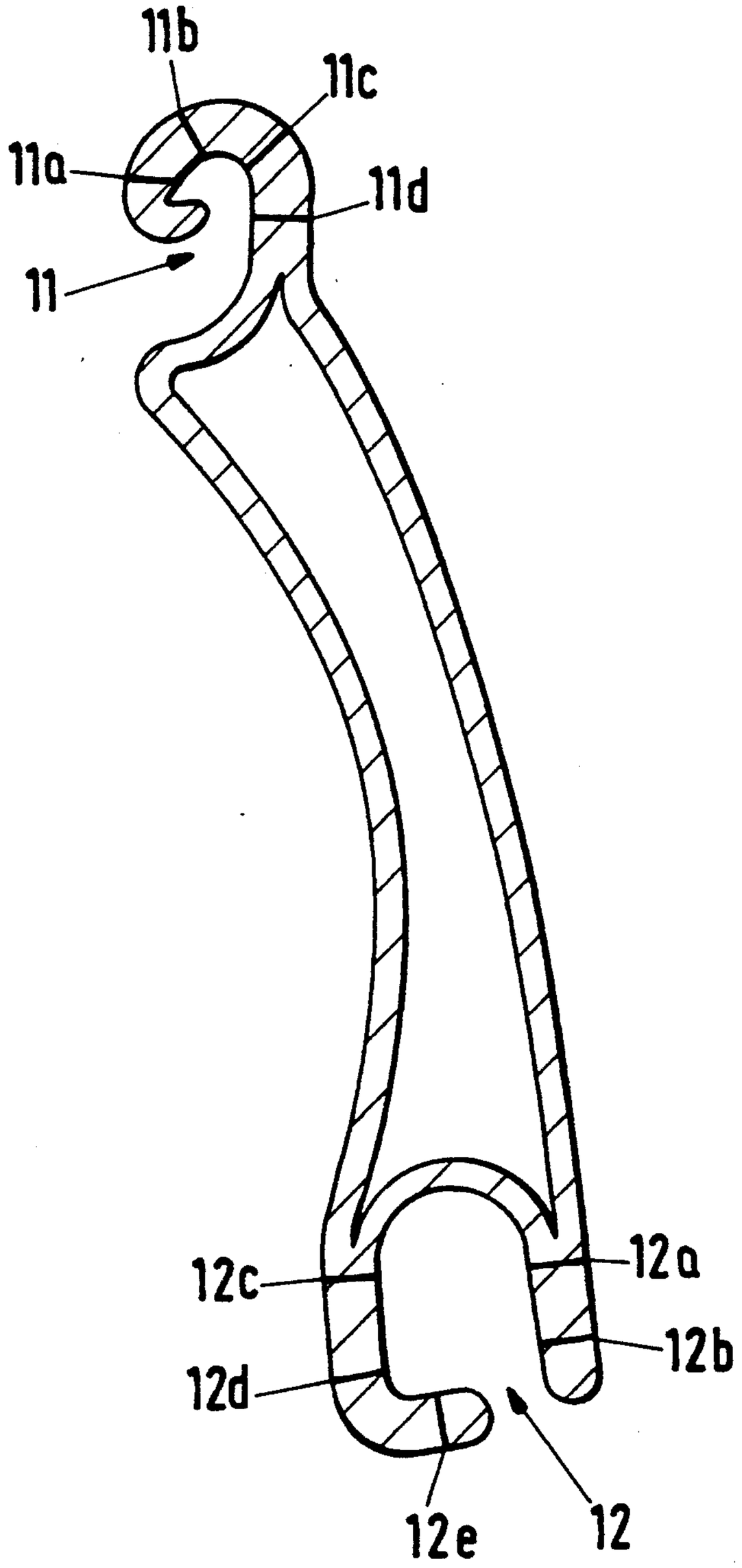
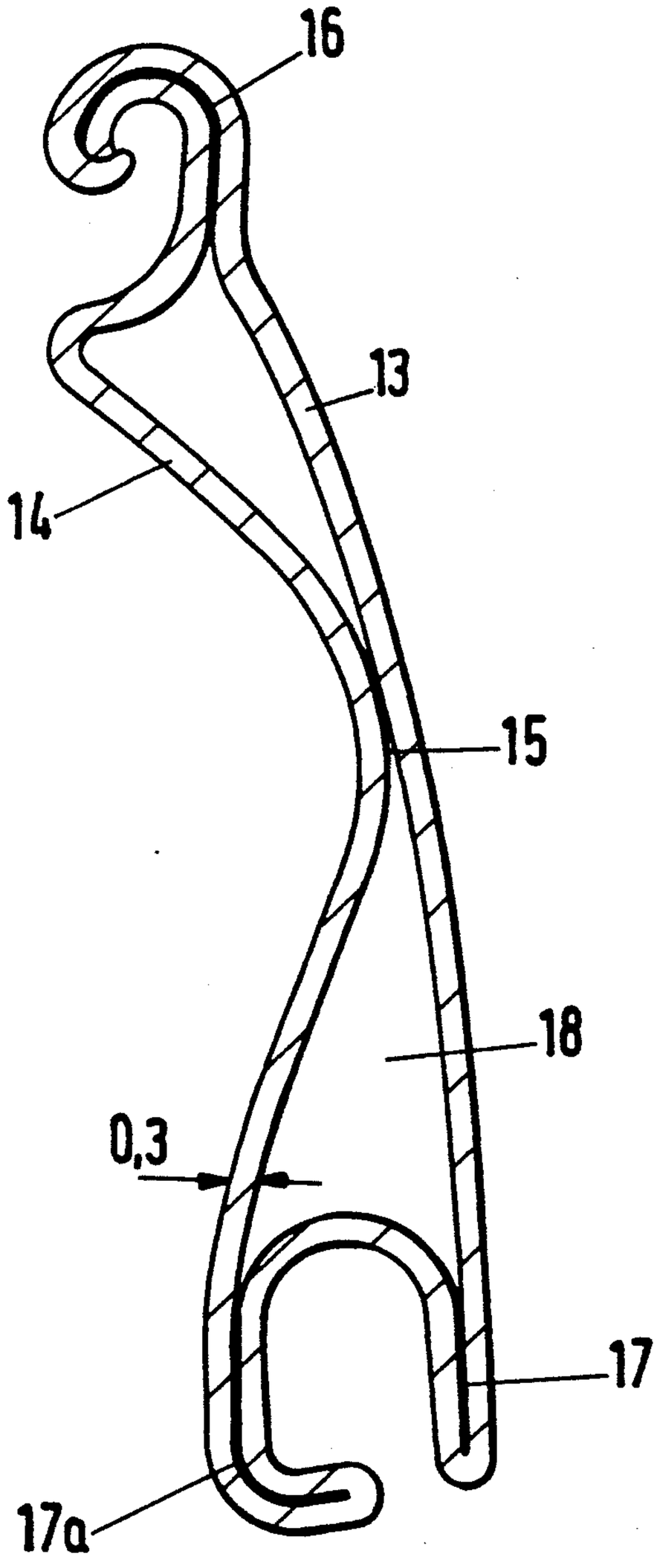


Fig.4



METHOD FOR THE MANUFACTURE OF A ROLLER SHUTTER SLAT

This is a division of pending application Ser. No. 07/662,932, filed Mar. 1, 1991.

BACKGROUND OF THE INVENTION

The invention refers to a roller shutter slat of stable shape, which consists of an aluminium strip roll-formed into a hollow section, and a method for the manufacture of such a dimensionally stable roller shutter member.

A roller shutter slat of stable shape, which features in the centerline of the hollow section a reinforcing part, is known from EP 00 75768. Said reinforcing part consists of a PVC insert, which can be additionally reinforced during manufacture by the extrusion process by means of a metallic core. The finished roller shutter slat of plastic material features disadvantages of weathering exposure, especially at exposure to solar radiation and low temperatures. Under these conditions, there can result an embrittlement of the plastic material, and after a longer exposure also a decolourizing of the outer coating. In addition, the manufacturing procedure is extremely time-consuming and expensive.

A roller shutter slat is known from the German registered utility patent G 8907445, which is roll-formed with the formation of connecting areas and walls from a plastic-coated aluminium strip. In this known roller shutter slat the coatings of the walls feature differing coating weights per unit area, so that it is possible to achieve a dampening of the vibrations of the section, and thus a reduction of sound emission.

Another roller shutter slat is described in the European patent application EP 03 65 908, which is roll-formed from a one-side coated aluminium strip into a hollow section. A double-layer plastic coating being formed in the area of the connecting areas, which ensures a damping of the sound radiated by the roller shutter, as the acoustic decoupling of the aluminium surfaces prevents the transmission of sound between same.

The invention is based on the task of realizing a roller shutter slat of stable shape, featuring improved bending strength and durability, without reducing the acoustic damping properties. The task of the invention is also the specification of a manufacturing method for such a roller shutter slat of stable shape with high bending strength and durability.

SUMMARY OF THE INVENTION

The task is solved in a roller shutter slat of stable shape of the initially mentioned type by following features:

the aluminium strip is plastic-coated on one side at least in part,

the coated side of the aluminium strip forms the inside of the hollow section,

the hollow section features upper and lower connecting areas, in which the aluminium strip is arranged in a double layer,

the hollow section features an inside wall and an outside wall,

the hollow section features at least one contact point, at which at least two aluminium strip layers are bonded with one another.

The durability of the roller shutter slat of stable shape is the result of the fact that it consists of resistant aluminium in the areas exposed to weathering. The improved bending strength is due to the fact that in the area of the at least two aluminium strip layers a shifting of same in opposite directions, especially when subjected to torsional strain, is no longer possible. This is advantageous particularly in case of thermal stress, e.g. direct exposure to solar radiation of the roller shutter slat. The distortions occurring in known roller shutter slat in which the ends of the hollow sections running in guides slew about the longitudinal centerline, are prevented in the roller shutter slat according to the invention.

In a preferred embodiment of the invention, the connection of the at least two aluminium strip layers is formed by a plastic coating designed as hot-melt adhesive coating in the area of the contact point. The material contact in the area of the adhesive coating results in the bond desired. To this end, it is sufficient if the hot-melt adhesive coating is applied to the edge zones of the aluminium strip, which are facing each other in the double-layer formed strip areas after roll forming. In parts less heavily stressed, a glue joint formed by means of a plastic foil, which is either applied to the aluminium strip prior to roll forming, or separately introduced during roll forming before or after the roll former into the forming process, is sufficient. If the glued joint is to be restricted to the edge zones, it is sufficient to introduce a correspondingly narrow plastic strip together with hot-melt adhesive coating on both sides of the roller shutter slat.

If the bond of the at least two aluminium strip layers is formed by a riveted, screwed or clinched connection, it is possible to achieve a good and, if desired, also detachable mechanical fixing.

The bond is preferably provided in one of the connecting areas, however, it is possible to fix correspondingly also both connecting areas.

In another embodiment of the invention, the at least two aluminium strip layers are formed by the inside wall and the outside wall, which are joined at a contact point into a bond. This design ensures not only the mechanical fixing of the surfaces in the connecting area, but also the reinforcement of the central area of the hollow section in at least one point, in order to increase the bending strength. This results, moreover, in a change of the resonance behaviour of the roller shutter slat and thus in an improvement of sound damping. The fixing between the inside wall and the outside wall is preferably achieved by deforming the inside wall in the direction to the outside wall, so that in the area of the contact point the inside wall features a smaller bending radius than the outside wall.

The roller shutter slat of stable shape according to the invention is preferably roll-formed from aluminium strip, which features a thicknes between 0.15 and 0.8 mm.

The method according to the invention for the manufacture of a roller shutter slat of stable shape includes, for the solution of the basic task, the following process steps: roll forming into a hollow section of a one-side plastic-coated aluminium strip with formation of double-layer connecting areas and of an inside wall as well as an outside wall, and establishment of a bond between at least two of the aluminium strip layers.

In addition to the process step of forming of the hollow section, it is provided according to the invention that, in the area where at least two aluminium strip layers are adjacent said layers are fixed to one another

by a bond, so that no displacement of the strip layers in the area of their contact point is possible. This results in the desired strengthening of the roller shutter slat.

The plastic material preferably consists of a bonding agent, the aluminium strip layers formed into a hollow section being pressurized in at least one of the two connecting areas until a bond has been established.

If the plastic coating consists of a hot-melt adhesive and the aluminium strip formed into the hollow section is glued or welded after heating in the area of the double-layer connecting areas, the material connection of the adhesive bond results in a particularly high bending stiffness.

A practical manufacturing procedure is ensured by the fact that the glueing or welding together takes place subsequently to the roll forming of the hollow section. The heating of the hot-melt adhesive can take place, however, also during the roll forming process by heating up of the aluminium strip.

An important variant of the method consists in the deformation of the inside wall in the direction of the outside wall in order to form a contact point.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated by several embodiments in the following:

The figures show:

FIG. **1** Roller shutter slat coated over the entire surface with adhesive agent in the hollow section interior space;

FIG. **2** Roller shutter slat coated with adhesive agent in the hook and lug area between the inside and outside wall of the aluminium strip;

FIG. **3** Roller shutter slat with mechanical linkage in the hook and lug area;

FIG. **4** Roller shutter slat with adhesive bonding between the inside and outside wall of the hollow section.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** shows the roller shutter slat according to the invention, consisting of the hollow section **1** and two connecting ends **2**, **3**, with the corresponding hook and lug areas **4**, **5**. The roller shutter slat was made by roll forming from an aluminium strip **6**, which is coated with a bonding agent **7** on the entire inside of the hollow section and also between the connecting ends.

The bonding agent **7** can be realized by extrusion coating, by application of a liquid, or by lamination of a polymer film. During roll forming, the bonding agent is pressure superposed at the connecting ends, and this results in an intimate contact between the bonding agent and the aluminium strip. This contact can be formed under the effect of heat into a bond, which withstands high mechanical loads.

A polyethylene copolymer has proved an adequate means for the coating of the aluminium strips. It is advantageous to provide the copolymer with sound-absorbing pigments, which are applied either in the liquid phase during extrusion on the aluminium strip, or contained already in the finished laminating agent. The all-over coating of the hollow section interior space substantially improves the sound-damping properties. The coating can also be made by means of a polypropylene film.

In FIG. **2**, the bonding agent is restricted to the contact points **8**, **9**, **10** at the connecting ends. This variant represents a simplified embodiment in comparison with the all-over coating illustrated in FIG. **1**, which features, however, equivalent results in terms of dimensional stability.

The advantage of this solution consists in simplified manufacture by use of correspondingly narrower plastic-coated areas at the contact points.

FIG. **3** shows a mechanical linkage at the connecting ends of the roller shutter slats. In this embodiment, several rivets **11***a–d* as well as **12***a–e* are figured in the hook area **11** and in the lug area **12**.

FIG. **4** shows now a bond in the form of a glued joint between the outside wall **13** and the inside wall **14** of the roller shutter member. To this end, the aluminium strip has been deformed in the central area of the inside wall **14** to form a contact point with the outside wall **13**. At this contact point, a previously applied bonding agent can effect the cramping. The cramping can be provided point-by-point at one or several contact points of the inside and outside wall, or also in a continuous line in the direction of the longitudinal centerline.

In addition to the glued joint **15** in the central area of the roller shutter slat, glued joints **16**, **17**, **17***a* are provided also at the connecting ends. All the glued joints can be basically made also in cold or hot condition. In case of higher strength requirements, however, it has proved advantageous to bond the aluminium strip areas provided with a bonding agent under the effect of heat. The heating temperatures of the bonding agent are above about 100° C., and preferably in the range of 150° to 200° C. The hot-melt adhesive is activated in this way, and the resulting strength of the hollow section corresponds to that of a hollow section of the same size foamed in place with PU-foam.

Heating can be effected by standard means, e.g. by infrared or induction heating elements, which are arranged at a suitable point during the roll forming of the roller shutter element according to the invention.

The finished product has to be subsequently cooled in an appropriate manner, e.g. by air jet.

After complete curing, roller shutter slats according to the invention can withstand a solar radiation of up to 80° C. temperature. All the suitable resins, acrylates and hot-melt adhesives, e.g. polyamides, can be used as adhesive between plastic and metal.

As described previously, in addition to the contact points at the connecting ends of the roller shutter slat, it is possible to provide contact points also in the central area at various points of the hollow section. The contact points are produced by deforming the initially parallel running aluminium strip between the connecting ends of the roller shutter slat the central area of the hollow section.

The inside wall **14** of the hollow section **18** is preferably deformed so that a contact point **15** with the outside wall **13** will result. It is possible, however, to deform the outside wall also, for example, in a bead manner, the bead bottom forming a contact point with the inside wall **14** of the hollow section **18**. Furthermore, both walls **13**, **14** can be deformed also simultaneously, if this is appropriate for higher strength and stability reasons.

The bond achievable by the glued joint in cold or hot condition can be produced also by other thermal processes, such as welding or soldering, or also by cold joining processes, such as contact pressure.

In addition, mechanical linking methods, such as riveting, screwing, clinching and other methods of forming under compressive conditions, are also applica-

ble. Decisive is the achievement of a temperature-resistant connection, capable of withstanding also an oscillating load, such as exerted by wind forces.

As mentioned initially, plastic materials and especially hot-melt adhesives can be used for the production of the bond. These are welded under the effect of heat (plastic materials), or glued (hot-melt adhesives). In addition to the copolymers such as polyethylene, mentioned in the description, polypropylene film can also be used.

It is also possible to use contact adhesives for the production of the bond. In this case the strip surfaces coated therewith are momentarily brought into contact under the effect of pressure, and a durable connection is thus realized at any point between the walls or connecting ends of the hollow section.

I claim:

1. A method for manufacturing a dimensionally stable roller shutter slat from an aluminum strip having a plastic coating along one of its sides, comprising

roll forming said aluminum strip into a generally rod-shaped structure having a hollow section with said plastic coating facing said hollow section, and upper and lower connecting areas wherein said aluminum strip is arranged in a double layer with a double layer of said plastic coating between individual layers of said double layer of aluminum strip, and

bonding said individual layers of said double layer of aluminum strip in at least one of said upper and lower connecting areas to each other by heating said plastic coating so as to form a consolidated plastic layer.

2. The method of claim 1 further comprising applying pressure to said connecting areas while heating said plastic coating.

3. The method of claim 1 wherein said plastic coating is a hot melt adhesive coating, wherein said aluminum strip is first roll formed, then thermally treated in at least one of said upper and lower connecting areas to melt said plastic coating on each of said individual layers, and thereby form said consolidated plastic layer.

4. The method of claim 1 wherein said bonding occurs by applying heat to said aluminum strip during said roll forming step.

5. The method of claim 1 wherein said aluminum strip is roll formed by means of a roll former and said plastic coating is heated by applying heat to said roll former.

6. The method of claim 1 wherein said plastic coating is heated before said roll forming step is completed.

7. The method of claim 1 further comprising deforming said hollow section during said roll forming step so that a contact point is formed between a first sidewall and a second sidewall of said hollow section.

8. The method of claim 7 further comprising bonding adjacent layers of said aluminum strip at said contact point.

9. The method of claim 8 wherein said adjacent layers are mechanically bonded to each other at said contact point.

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